JAGAT GURU NANAK DEV
PUNJAB STATE OPEN UNIVERSITY, PATIALA
A State University Established by Govt. of Punjab vide Act No. 19 of 2019 and Approved Under section 2(f) of UGC

School of Sciences & Emerging Technologies

Syllabi of the Courses for the Programme

M.Sc. (Computer Science)

From Admission Cycle July 2024

21/2/24

Semester-1

21/2/24

M.Sc. (Computer Science)
Semester-1
MSCS-1-01T: Computer Programming

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Computer Programming	
Course Code: MSCS-1-01T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand the basic language implementation techniques.
CO2	Develop C programs to demonstrate the applications of derived data types such as arrays, pointers, strings and functions.
CO3	Understand the concept of object oriented programming language.
CO4	Develop ability to learn and write small programs in C and C++.
CO5	Understand the concepts of OOPs including inheritance.

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SECTION-A

Unit I: **Problem Solving with Computers**: Evolution of C Language, Character Set in C, Tokens, Keywords, Identifier, Constants, Variables, Rules for defining Variables, Data Types in C Language: Basic data type, Derived data type and Enum data type.

Unit II: **Operators in C**: Types of Operator: Arithmetic, Relational, Logical, Comma, Conditional, Assignment, Operator Precedence and Associativity in C, Input and Output Statements, Assignment statements.

Unit III: Control Structure: Sequential Flow Statement, Conditional Flow Statement, Decision Control statements: if, if-else, nested-if, else-if ladder. Loop control statements: While, do-while, for loop, Nested of Loops. Case Control Statements: Switch Statement, goto Statement, Break Statement, Continue Statement.

Unit IV: **Arrays and Pointers in C:** Arrays, Characteristic of Arrays, Representation, Declaration and Initialization of an Array, Types of Arrays: one dimensional, multi-dimensional arrays. Pointer, Pointers Declaration and Initialization, Types of Pointers, Pointer Expressions and Pointer Arithmetic.

SECTION-B

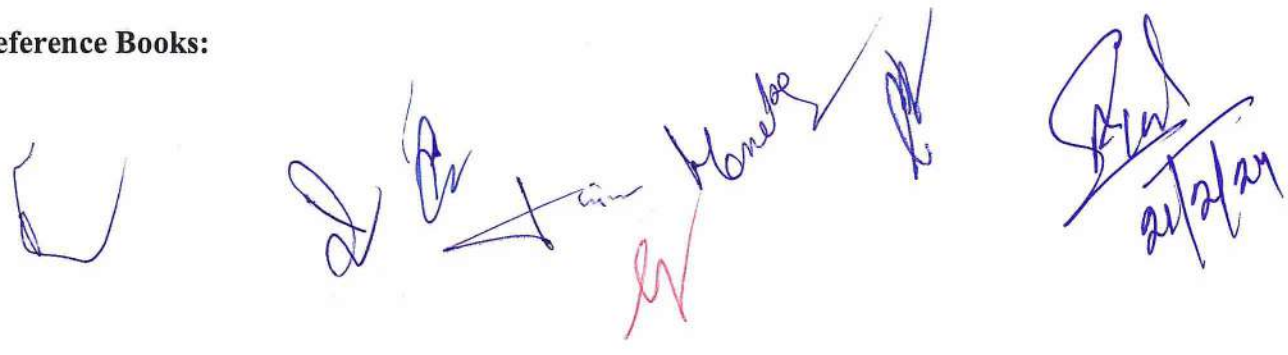
Unit V: **Functions:** Function in C, Function Declaration and Definition, Types of Functions, Library Vs. User-defined Functions, Function Calling Methods, Function Parameters: Actual Parameter, Formal Parameter, Parameter Passing Techniques: Call by Value and Call by Reference, Recursive Function, Pointers and Functions. Strings: C Strings, Difference between char array and string literal, Traversing String, Accepting string as the input, Pointers with strings, String Functions.

Unit VI: **User Defined Data types:** Structure, Structure Variables Declaration, Accessing Structure Data Members, Array of Structures, Nested of Structure, Passing structure to function, Structures Limitations, Union, Difference between Structure and Union in C.

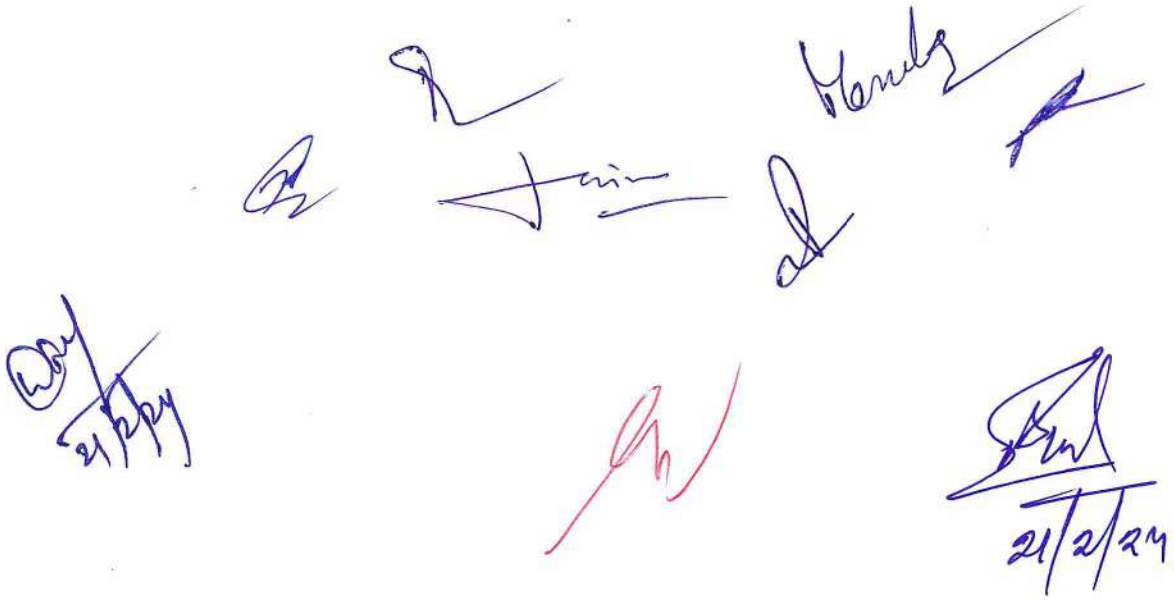
Unit VII: **Object Oriented Programming:** Need of an Object-Oriented Programming, C++ and its Applications, OOPs Concepts in C++: Class, Objects, Encapsulation, Abstraction, Polymorphism, Inheritance, Dynamic Binding and Message Passing. Access Specifiers in C++: Private, Protected and Public.

Unit VIII: **Constructor in C++:** Characteristics of Constructors, Difference between constructor and member function, Types of Constructors: Default Constructor, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructor in C++, Difference between Constructor and Destructor. Inheritance in C++, Modes of Inheritance, Type of Inheritance: Single inheritance, Multiple inheritance, Hierarchical inheritance, Multilevel inheritance, Hybrid inheritance.

Reference Books:



- E. Balagurusamy, "Programming in C", Tata McGraw Hill.
- Kamthane, "Programming with ANSI and Turbo C", Pearson Education
- Rajaraman,V, "Fundamentals of Computers", PHI
- Kanetkar, "Let Us C", BPB Publications.
- Herbert Schildt, "The Complete Reference C++", Tata McGraw-Hill.
- Deiteland Deitel, "C++ How to Program", Pearson Education.
- Robert Lafore, "Object Oriented Programming in C++", Galgotia Publications.
- Bjarne Strautrup, "The C++ Programming Language", Addition-Wesley Publication Co.
- Stanley B. Lippman, Josee Lajoie, "C++ Primer", Pearson Education.
- E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw-Hill



M.Sc. (Computer Science)
Semester-1
MSCS-1-01P: Computer Programming Lab

Total Marks: 50
External Marks: 15
Internal Marks: 35
Credits: 2
Pass Percentage: 40%

Course: Computer Programming Lab	
Course Code: MSCS-1-01P	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Develop C programs to solve simple mathematical and decision making problems.
CO2	Develop, Debug and Execute programs to demonstrate the applications of arrays in C
CO3	Develop, Debug and Execute programs to demonstrate decision making and looping constructs in C
CO4	Develop, Debug and Execute programs to demonstrate the basic concepts of pointers in C
CO5	Demonstrate the use of various OOPs concepts with the help of programs.

Detailed List of Programs:

Programme No.	Name of Program
P1	Write a simple program that prints "Hello, World!" to the console.
P2	Take two numbers as input and display their sum.
P3	Generate and print the multiplication table for a given number.
P4	Compute the factorial of a given number.
P5	Check whether a given number is prime or not.
P6	Generate and display the Fibonacci series up to a specified number of terms.
P7	Determine if a given number or string is a palindrome.
P8	Reverse a given string without using library functions.
P9	Implement a sorting algorithm (e.g., bubble sort, selection sort) for an

	array of integers.
P10	Search for an element in an array using linear search.
P11	Implement binary search for a sorted array.
P12	Perform addition of two matrices.
P13	Find and display the transpose of a matrix.
P14	Implement a program to calculate the power of a number using recursion.
P15	Create a basic calculator program that performs addition, subtraction, multiplication, and division.
P16	Compute the factorial of a number using a recursive function.
P17	Check whether a given number is an Armstrong number.
P18	Calculate the GCD of two numbers using Euclidean Algorithm.
P19	Convert a decimal number to its binary equivalent.
P20	Reverse the words in a given sentence without using library functions.

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M.Sc. (Computer Science)
Semester-1
MSCS-1-02T: Data Base Management System (DBMS)

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

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5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: DBMS	
Course Code: MSCS-1-02T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand the fundamental elements of database management system.
CO2	Understands the three level architecture of DBMS and mapping between these levels.
CO3	Familiar with the hierarchical model, network model, entity relationship model and relational model.
CO4	Acquire knowledge of normalization technique that reduces data redundancy and eliminates undesirable characteristics like Insertion, Update and Deletion Anomalies.
CO5	Apply SQL and PL/SQL to solve problems

SECTION-A

Unit I: Introduction of DBMS: Database Approach, Characteristics of a Database Approach, Database System Environment. Roles in Database Environment: Database Administrators, Database Designers, End Users, Application Developers. Database Management Systems: Definition, Characteristics, Advantages of Using DBMS Approach, Classification of DBMSs.

Unit II: Three Level Architecture of DBMS: Database Schema and Database Instance, Mapping Between Different Views, Data Independence–Physical and Logical Data Independence, Difference between logical data independence and physical data independence, Components of a DBMS, Data Dictionary, DBMS Languages

Unit III: Data Models: Classification of Data Model, Hierarchical Model, Network Model, Entity Relationship Model, Database Conceptual Modeling by E-R model: Concepts, Entities and Entity Sets, Attributes, Mapping Constraints, E-R Diagram, Weak Entity Sets, Strong Entity Sets, Comparison between Data Models.

Unit IV: Relational Data Model: Concepts and Terminology. Constraints: Integrity Constraints, Entity and Referential Integrity constraints, Keys: Super Keys, Candidate Keys, Primary Keys, Secondary Keys and Foreign Keys. Relational Algebra: Basic Operators, Additional Operators. Relational Calculus: Tuple Relational Calculus and Domain Relational Calculus, Difference between relational algebra and relational calculus.

SECTION-B

Unit V: Normalization: Functional Dependency, Full Functional Dependency, Partial Dependency, Transitive Dependency, Normal Forms– 1NF, 2NF, 3NF, BCNF, Multi-valued Dependency, Join Dependency and Higher Normal Forms-4NF, 5NF.

Unit VI: Transaction Management and Concurrency Control: ACID Properties. Database Protection: Security Issues, Discretionary Access Control-Granting and Revoking Privileges. Database Concurrency: Problems of Concurrent Databases, Serializability and Recoverability, Concurrency Control Methods-Two Phase Locking, Time Stamping. Deadlock, Database security and integrity, Different Methods of Database Security, Database Recovery: Recovery Concepts, Recovery Techniques-Deferred Update, Immediate Update, Shadow Paging.

Unit VII: Introduction to SQL: Introduction to SQL*PLUS, Data types, Parts of SQL: Data Definition Language, Data Manipulation Language, Data Control Language, and Transaction Control Language. SQL Operators, SQL Functions, Joins, Roll up operation, Cube operation, Nested query, Subquery, View, Disadvantages of SQL

Unit VIII: Introduction to PL/SQL: Difference between SQL and PL/SQL, Block structure of PL/SQL, Architecture of PL/SQL, Elements and Data Types of PL/SQL, Variables and Constants of PL/SQL, Control structures of PL/SQL, Cursors, Exception handling,

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Subprograms, Stored packages, Triggers

Reference Books:

- Elmasry Navathe, "Fundamentals of Database System", Pearson Education.
- Oracle SQL Complete Reference", Tata McGraw-Hill.
- T.Connolly, C Begg,"Database Systems", Pearson Education.
- Jeffrey D. Ullman, "Principles of Database Systems", Galgotia Publications.
- Henry F. Korth, A. Silberschhatz, "Database Concepts", Tata McGraw Hill.
- C. J. Date, "An Introduction to Database Systems", Pearson Education.

M.Sc. (Computer Science)
Semester-1
MSCS-1-02P: Data Base Management System (DBMS) Lab

Total Marks: 50
External Marks: 15
Internal Marks: 35
Credits: 2
Pass Percentage: 40%

Course: DBMS Lab	
Course Code: MSCS-1-02P	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Implement Basic DDL, DML and DCL commands.
CO2	Understand Data selection and operators used in queries and restrict data retrieval and control the display order.
CO3	Use Aggregate and group functions to summarize data.
CO4	Join multiple tables using different types of joins.
CO5	Understand the PL/SQL architecture and write PL/SQL code for procedures, triggers, cursors, exception handling etc.

Detailed List of Programs: Detailed List of Programs:

Programme No.	Name of Program
P1	Implementation of DDL commands of SQL with suitable examples • Create table • Alter table • Drop Table
P2	Implementation of DML commands of SQL with suitable examples • Insert • Update • Delete
P3	Implementation of different types of function with suitable examples • Number function • Aggregate Function • Character Function • Conversion Function • Date Function

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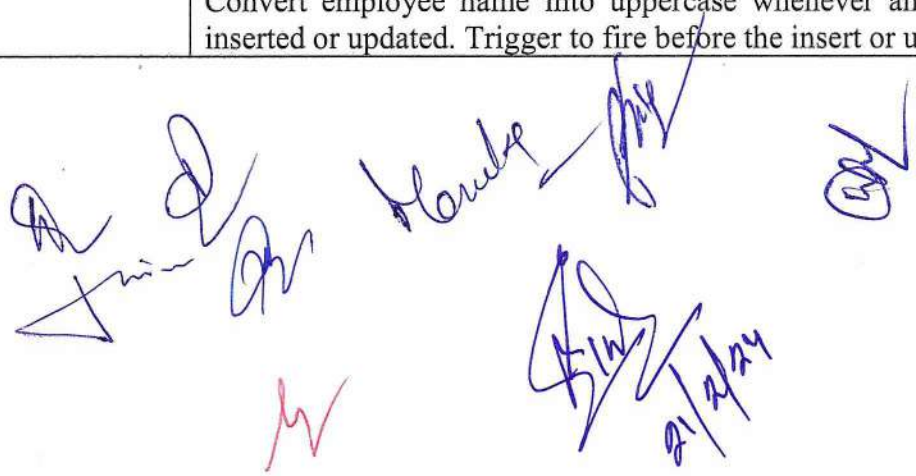
P4	Implementation of different types of operators in SQL • Arithmetic Operators • Logical Operators • Comparison Operator • Special Operator • Set Operation
P5	Implementation of different types of Joins • Inner Join • Outer Join • Natural Join etc.
P6	Implementation of • Group by & having clause • Order by clause • Indexing
P7	Implementation of • Sub queries • Views
P8	Study & Implementation of different types of constraints.
P9	Study & Implementation of Database Backup & Recovery commands.
P10	Study & Implementation of Rollback, Commit, Save point
P11	Creating Database /Table Space • Managing Users: Create User, Delete User • Managing roles:-Grant, Revoke
P12	Study & Implementation of PL/SQL.
P13	Write a PL/SQL program to find the factorial of a given number.
P14	Calculate the net salary and year salary if DA is 30% of Basic, HRA is 10% of Basic and PF is 7% if Basic Salary is less than 8000, PF is 10% if Basic Salary between 8000 to160000.
P15	Study & Implementation of SQL Triggers.
P16	Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values
P17	Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update.



M.Sc. (Computer Science)
Semester-1
MSCS-1-03T: Probability & Statistical Analysis

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

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3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
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5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Probability & Statistical Analysis	
Course Code: MSCS-1-03T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Apply measures of central tendency for analysis of data.
CO2	Learn tabulated and graphical representation techniques for discrete and continuous data.
CO3	Infer the concept of correlation and regression for two or more related variables.
CO4	Understand the fundamentals of statistics to apply descriptive measures and probability for data analysis.

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CO5	Understand the concepts of Random Variable, Probability Mass Function and Density Function.

SECTION-A

Unit I: Origin and Development of Statistics: Scope, limitation and misuse of statistics. Types of data: primary, secondary, quantitative and qualitative data. Types of Measurements: nominal, ordinal, discrete and continuous data.

Unit II: Presentation of Data by Tables: construction of frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions. Classification and Graphical representation of data (Pie Chart, Bar Diagram, Histogram, Frequency Polygon, Ogive Curve, etc.).

Unit III: Measures of Central Tendency: Arithmetic Mean, Median and Mode and its Graphical representation, Measures of dispersion – range, variance, mean deviation, standard deviation and Coefficient of variation, Concepts and Measures of Skewness and Kurtosis.

Unit IV: Descriptive Statistics: Exploratory data analysis, Coefficient of variation, Data visualization, Scatter diagram, Grouped data.

SECTION-B

Unit V: Correlation: Scatter plot, Karl Pearson coefficient of correlation, Spearman's rank correlation coefficient, multiple and partial correlations (for 3 variates only). Regression: Introduction to regression analysis: Modelling a response, overview and applications of regression analysis, Simple linear regression (Two variables)

Unit VI: Mathematical and Statistical probability: Elementary events, Sample space, Compound events, Types of events, Random experiment, sample point and sample space, event, algebra of events.

Unit VII: Definition of Probability: classical, empirical and axiomatic approaches to probability, properties of probability. Theorems on probability, conditional probability and independent events

Unit VIII: Statistical inference: Concept of Random Variable, Probability Mass Function & Density Function, Mathematical Expectation (meaning and properties), Moments, Moment Generating Function and Characteristic Function.

Reference Books:

- Gupta, S.C. and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan & Chand & Sons, New Delhi, 11th Ed.
- Hastie, Trevor, et al. "The elements of Statistical Learning", Springer.
- Ross, S.M., "Introduction to Probability and Statistics", Academic Foundation.
- Papoulis, A. and Pillai, S.U., "Probability, Random Variables and Stochastic Processes", TMH.

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M.Sc. (Computer Science)
Semester-1
MSCS-1-04T: Fundamentals of Digital Marketing

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

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5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

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Course: Digital Marking	
Course Code: MSCS-1-04T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Identify the core concepts of digital marketing and its role in businesses or organizations.
CO2	Understand digital marketing strategies to reach the target audience.
CO3	Analyze marketing approaches and recognize areas for enhancing performance.
CO4	Resolve digital marketing issues and offer solutions based on the vital examination of digital marketing information.

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CO5	Work on social media platforms such as Twitter, Facebook and Instagram

Detailed Contents:

Module	Module Name	Module Contents
Section A		
Module 1	**Introduction to Digital Marketing**	Concepts, Traditional Marketing vs. Digital Marketing, Digital Market Evolution, Career in Digital Marketing.
Module II	**Digital Consumer**	Consumer Characteristics and profiles, Information Search Behavior, Factors Influencing Consumption Behavior, Purchase Decision Process, Post Purchase Behavior and Management.
Module III	**Digital vs Non- Digital Marketing Strategy**	Digital vs Non- Digital Marketing Strategy, Digital Marketing Decisions- Product, Price, Distribution and Promotion.
Section B		
Module IV	**Digital Marketing Strategy Formulation and Execution Digital Marketing Mechanisms**	Digital Marketing Strategy Formulation and Execution Digital Marketing Mechanisms: Websites- Company and Retail Service Providers, Search.
Module V	**Search Engines**	Search Engines- Google, Bing, Ask, Yahoo Video Hosting and Entertainment-Youtube, Wimeo, Amazon Prime, Netflix, Hotstar.
Module VI	**Social Media**	Mobile Phones, E- Mails, Blogs, Social Media: Facebook, Instagram, Twitter, Whatsapp.

Books

1. Seema Gupta, "Digital Marketing", McGraw Hill Education
2. PModule Singh Bhatia, "Fundamentals of Digital Marketing", Pearson
3. Philip Kotler, "Marketing 4.0: Moving from Traditional to Digital", Wiley

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Semester-2

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M.Sc. (Computer Science)
Semester-2
MSCS-2-01T: Operating Systems

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
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5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Operating Systems	
Course Code: MSCS-2-01T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand the structure of computing systems, from the hardware level through the operating system level and onto the applications level.
CO2	Understand basics of operating system viz. system programs, system calls, user mode and kernel mode.
CO3	Learn the working with CPU scheduling algorithms for specific situation, and analyze the environment leading to deadlock and its rectification.
CO4	Explore the memory management techniques viz. caching, paging, segmentation, virtual memory, and thrashing.
CO5	Apply Methods for Handling Deadlocks, Deadlock Prevention, and Recovery from Deadlock.

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SECTION-A

Unit I: Introduction and System Structures: Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments, Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs.

Unit II: Process Management: Process Concept, Process Scheduling, Operations on Processes, Multi-threaded programming: Multithreading Models, Process Scheduling: Basic Concepts, Scheduling Criteria, and Scheduling Algorithms.

Unit III: Deadlock: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit IV: Memory Management: Basic Hardware, Address Binding, Logical and Physical Address, Dynamic linking and loading, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Demand Paging, Page Replacement algorithms

SECTION-B

Unit V: File Systems: File Concept, Access Methods, Directory and Disk Structure, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Unit VI: **Introduction to Linux:** Linux's shell, Kernel, Features of Linux, using file system: Filenames, Introduction to different types of directories: Parent, Subdirectory, Home directory; rules to name a directory, Important directories in Linux File System,

Unit VII: Linux Commands: Cal, date, echo, bc, who, cd, mkdir, rmdir, ls, cat cp, rm, mv, more, gzip, tar, File ownership, file permissions, chmod, Directory permission, change file ownership,

Unit VIII: Shell Scripting: Creating and Executing Shell Programs, using variables: Assigning a value to a variable, Accessing the value of a variable, Positional Parameters and other Built-In Shell Variables; Special Characters, Conditional Statements: if Statement, case Statement; Iteration Statements: for Statement, while Statement, until Statement

Reference Books:

- Silberschatz and Galvin, "Operating System Concepts", Addison-Wesley publishing.
- Nutt Gary, "Operating Systems", Addison Wesley Publication.
- Hansen, Per Brinch, "Operating System Principles", Prentice-Hall.

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- N. Haberman, "Introduction to Operating System Design", Galgotia Publications.
- Hansen, PerBrich, "The Architecture of Concurrent Programs", PHI.
- Shaw, "Logical Design of Operating System", PHI.

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M.Sc. (Computer Science)
Semester-2
MSCS-2-01P: Operating Systems Lab

Total Marks: 50
External Marks: 15
Internal Marks: 35
Credits: 2
Pass Percentage: 40%

Course: Operating Systems Lab	
Course Code: MSCS-2-01P	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Demonstrate the installation process of various operating systems.
CO2	Implement virtualization by installing Virtual Machine software.
CO3	Apply UNIX/LINUX operating system commands.
CO4	Understand different UNIX/LINUX shell scripts
CO5	Implement and execute various shell programs.

Detailed List of Programs:

Programme No.	Name of Program
P1	Install UNIX/LINUX – Complete Step by Step
P2	Study of Basic UNIX Commands and various UNIX editors such as vi, ed, ex and EMACS
P3	Write a shell script that deletes all lines containing the specified word in one or more files Supplied as arguments to it.
P4	Write a shell script that displays a list of all files in the current directory to which the user has read, write and execute permissions
P5	Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or directory and reports accordingly. Whenever the argument is a file it reports no of lines present in it
P6	Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the

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	first argument file on other argument files.
P7	Write a shell script to list all of the directory files in a directory
P8	Write a shell script to find factorial of a given number
P9	Write an awk script to count number of lines in a file that does not contain vowels
P10	Write an awk script to find the no of characters ,words and lines in a file
P11	Implement in C language, the following Unix commands using system calls a) cat b) ls c) mv
P12	Write a C program that takes one or more file/directory names as command line input and reports following information
P13	Write a C program to list every file in directory, its inode number and file name
P14	Write a C program to create zombie process
P15	Write a C program to illustrate how an orphan process is created
P16	Write client server programs using c for interaction between server and client process using Unix Domain sockets

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M.Sc. (Computer Science)
Semester-2
MSCS-2-02T: Data Structure & Algorithms

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

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INSTRUCTIONS FOR THE CANDIDATES

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Course: Data Structure & Algorithms	
Course Code: MSCS-2-02T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand basic data structures such as arrays, linked lists, stacks and queues.
CO2	Solve problem involving graphs, trees and heaps.
CO3	Apply stack for evaluation of arithmetic expressions, and conversion from infix to post fix and recursion.
CO4	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
CO5	Design algorithm in context of space and time complexity and apply asymptotic notation.

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SECTION-A

Unit I: Data Structure: Introduction to data structure and algorithm, various phases of algorithms, Pointers, working with pointers, pointers and function, structure, union, classification of data structures Algorithm analysis: Time space trade off algorithms and Big O notation.

Unit II: Arrays: Introduction, one dimensional and multidimensional arrays, memory representation of arrays, operations on arrays, sparse arrays and sparse matrices and their implementation, Advantages and limitation of arrays.

Unit III: Linked List: Introduction; operation on linked list, circular linked list, doubly linked list, header linked list, implementation of linked list, application of linked lists.

Unit IV: Stacks: Introduction; array representation of stacks, Operation on stacks; Linked representation of stacks, Application of stacks: matching parenthesis, evaluation of arithmetic expressions, and conversion from infix to post fix, recursion.

SECTION-B

Unit V: Queues: Introduction, operation on queues, linked representation of queue, Applications of queues, circular queue, memory representation of queues, priority queues, Multiple queues.

Unit VI: Trees: Introduction; Binary Tree; Complete Binary Trees, Extended Binary Trees, representation of binary trees in the memory, traversing a binary tree, Binary Search Tree, Operations on Binary Search Tree; Balanced Trees- AVL; B- Trees; Heap, Applications of trees.

Unit VII: Graphs: Introduction Graph: Graph terminology, Memory Representation of Graphs: adjacency matrix representation of graphs, adjacency list or linked representation of graphs, graph traversal algorithms, Operations performed on graphs.

Unit VIII: Searching: Linear Search, Binary Search, Fibonacci Search, Sorting: Selection Sort, Insertion Sort, Merge Sort, Bucket Sort, Radix Sort, Quick Sort and Heap Sort.

Reference Books:

- A. Tanenbaum, Y. Lanhgsamand A. J. Augenstein, "Data Structures Using C", PHI.
- Loomis, Marry, "Data Management and File Structures", PHI
- Seymour Lipschultz, "Theory and Practice of Data Structures", Tata McGraw-Hill.
- E. Horowitz and S. Sahni, "Data Structures with Pascal", Galgotia.
- M. J. Folk, B. Zoellick, G Riccardi, "File Structures", Pearson Education.

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M.Sc. (Computer Science)
Semester-2
MSCS-1-01P: Data Structure & Algorithms Lab

Total Marks: 50
External Marks: 15
Internal Marks: 35
Credits: 2
Pass Percentage: 40

Course: Data Structure & Algorithms Lab	
Course Code: MSCS-2-02P	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Implement basic data structures such as arrays and linked list.
CO2	Develop programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
CO3	Implement various searching and sorting algorithms.
CO4	Develop programs to demonstrate the implementation of various operations on stack
CO5	Develop programs to demonstrate the implementation of various operations on queue

Detailed List of Programs:

Program No.	Name of Program
P1	WAP to demonstrate the concept of one dimensional array finding the sum of array elements.
P2	WAP to insert an element in an array
P3	WAP to delete an element from an array.
P4	WAP to insert an element at the beginning of a linked list
P5	WAP to insert an element at the end of a linked list
P6	WAP to insert an element within the linked list
P7	WAP to demonstrate PUSH and POP operations of stack using array
P8	WAP to demonstrate the implementation of queue using linked list
P9	WAP to search an element from an linear array using linear search.
P10	WAP to Search an element using binary search.
P11	WAP to arrange the list of numbers in ascending order using Bubble Sort.
P12	WAP to arrange the list of numbers in ascending order using Insertion

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	Sort.
P13	WAP to arrange the list of numbers in ascending order using Selection Sort.
P14	WAP to arrange the list of numbers in ascending order using Heap Sort.
P15	WAP to arrange the list of numbers in ascending order using Quicksort Sort.
P16	WAP to arrange the list of numbers in ascending order using Merge sort.
P17	WAP to demonstrate the operation of Pre order Traversing technique of Tree
P18	WAP to demonstrate the operation of Post order Traversing technique of Tree
P19	WAP to implement a simple Depth-First Search (DFS) traversal in Graph .
P20	WAP to implement a simple Breadth-First Search (BFS) traversal in Graph.

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M.Sc. (Computer Science)
Semester-2
MSCS-2-03T: Introduction to Cyber Security

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Introduction to Cyber Security	
Course Code: MSCS-2-03T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand network security threats, security services, and countermeasures.
CO2	Understand principles of network security by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.
CO3	Develop cyber security strategies and policies
CO4	Measure the performance and troubleshoot cyber security systems.
CO5	Understand various Cryptographic Techniques

SECTION-A

Unit I: Cyber Attacks: Introduction, Types. Assets: Identification, Accountability. Vulnerability and Threats, Risk Management, Qualitative Risk Assessment, Information Security Framework: Introduction, Policies, Standards, Baselines, Guidelines and Procedures.

Unit II: Security: Basics, User Access Controls, Authentication, Access Control: Framework, Techniques and Technologies, Training and Awareness and Its types, Technical Security Controls: Preventive, Detective, Corrective. Protection form malicious attacks.

Unit III: Networks and Communication: Data Communication, Characteristics and components, Data flow. Computer Network, Categories, Protocol, External Services, Cloud Computing: Introduction, Models, Benefits, Challenges, Private, Public Clouds.

Unit IV: Software Engineering Life Cycle: Stages, Models: Waterfall, Iterative, Spiral, V Model, Big Bang, Agile, RAD, Prototype.

SECTION-B

Unit V: Authentication: Authentication Vs Authorization, Methods and Protocols: Kerberos, SSL, Protocol, Password Authentication, Challenge-Handshake Authentication (CHAP), MSCHAP, Extensible Authentication, Remote Authentication.

Unit VI: Service Set Identification (SSID), Encryption Methods: Wire Equivalent Privacy, WPA, WPA2, MAC Filtering, Wireless Routers, Creating Wireless Network, WLAN.

Unit VII: Investigation Techniques and Cyber Forensics: Types of Investigation, Evidence and Analysis, Steps for Forensics Investigation, Forensics Tools, Investigation, Common Types of Email Abuse, Tracking Location of Email Sender, Scam or Hoax Emails and Websites, Fake Social Media Profile.

Unit VIII: Cryptography: Objectives, Type, OS Encryption, Public key Cryptography.

Reference Books:

- Mayank Bhushan, Rajkumar Singh Rathore, Aatif Jamshed, "Fundamentals of Cyber Security", BPB Publications.
- Nina Godbole, Sunit Belapure, "Cyber Security", Wiley.
- Sanil Nadkarni, Fundamentals of Information Security", pbp.
- Mike Chapple, James Michael Stewart, Darril Gibson, "CISSP Certified Information Systems Security Professional Official Study Guide" 9th Edition, SYBEX, A Wiley Brand.
- William Chuck Eastton, "Computer Security Fundamentals", 4th Edition, Pearson.

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M.Sc. (Computer Science)
Semester-2
MSCS-2-04T: Software Engineering

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Software Engineering	
Course Code: MSCS-2-04T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand the software development life cycle which increases the growth opportunity.
CO2	Learn the detail knowledge of software requirement analysis.
CO3	Understands the detailed knowledge of software design and coding.
CO4	Understand the software testing that is relevant to the industry.
CO5	Acquire the detail knowledge of the fundamentals, including terminology; the nature and need for maintenance; maintenance costs and software evolution

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SECTION-A

Unit I: Introduction of Software Engineering: The Problem Domain, Software Engineering, Challenges, Software Engineering Approach. Software development life cycle and its phases, Software development process models: Waterfall, Prototyping, Iterative.

Unit II: Software Process: Characteristics of software process, Project management process, Software configuration management process.

Unit III: Project Planning: Activities, COCOMO model. Software Metrics – Definition, Importance, Categories of metrics. Software Quality – Attributes, Cyclomatic complexity metric.

Unit IV: Software Requirements Analysis: Need for SRS, Data flow diagrams, Data Dictionary, entity relationship diagram, Characteristics and components of SRS, validation, metrics.

SECTION-B

Unit V: Software Design: Design principles, Module-level concepts, Structure Chart and Structured Design methodology, verification, metrics: network metrics, information flow metrics.

Unit VI: Coding: Programming Principles and Guidelines, Verification- code inspections, static analysis.

Unit VII: Software Testing: Testing fundamentals, Black Box Testing: Equivalence class partitioning, Boundary value analysis, cause-effect graphing; White Box Testing: Control flow and Data flow based testing, mutation testing; levels of testing, test plan, test case specification, test case execution and analysis.

Unit VIII: Software Maintenance: Categories of maintenance. Software Reliability – Definition, uses of reliability studies

Reference Books:

- Pankaj Jalote, "An Integrated approach to Software Engineering", 3rd Edition 2005, Narosa Publications.
- K.K. Aggarwal, Yogesh Singh, "Software Engineering", Revised 2nd Edition, New Age International Publishers.
- Roger. S. Pressman, "Software Engineering – A Practitioner's Approach", 5th Edition, Tata McGraw Hill.

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Semester-3

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M.Sc. (Computer Science)
Semester-3
MSCS-3-01T: Web Programming

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Web Programming	
Course Code: MSCS-3-01T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand the principles of creating an effective web page, including an in-depth consideration of information architecture.
CO2	Develop skills in analysing the usability of a web site.
CO3	Become familiar with graphic design principles that relate to web design and learn how to implement theories into practice.
CO4	Learn techniques of responsive web design, including media queries.
CO5	Derive information from data and implement data into applications

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SECTION-A

Unit 1: Java and the Internet: The Java programming language and its characteristics; Java development kit, Java run- time environment; Java compiler.

Unit II: Fundamentals of Java: Java Vs. C++, Byte Code, Java Virtual Machine, constants, variables, data types, operators, expressions, control structures, defining class, creating objects, accessing class members, constructors, Garbage Collection, method overloading.

Unit III: Inheritance: Different types of Inheritance, member access, using super keyword to call super class constructors, creating a multilevel hierarchy, method overriding, dynamic method dispatch, using abstract classes, using Final keyword.

Unit IV: I/O Basics: streams, the predefined streams; Reading console Input, Writing console Output. Arrays and Strings: One-dimensional and two-dimensional Arrays, String Handling using String and String Buffer class, String Functions.

SECTION-B

Unit V: Packages: Types of packages, defining a package, importing packages, Access protection Interfaces: Defining an Interface, Implementing Interfaces, Variables in Interfaces, achieving multiple inheritance using interfaces, Interface and Abstract classes.

Unit VI: Exception Handling: Java Exception handling model, Types of exception, using Try and catch, Multiple Try and Catch clauses, Nested Try statements, finally block, user defined exceptions.

Unit VII: Multi-threaded Programming: The Java Thread model, the Thread class and Runnable interface, creating a Thread using Runnable Interface and extending Thread, Creating Multiple Threads, Thread Priorities, Synchronizations: Methods, Statements, Inter Thread Communication, Deadlock, Suspending, Resuming and Stopping Threads.

Unit VIII: Applet Programming: Introduction, Types of applet, Life Cycle, incorporating an applet into web page using Applet Tag, running applets, using Graphics class and its methods to draw lines, rectangles, circles, ellipses, arcs and polygons

Reference Books:

- Balaguruswamy, E., "Programming with Java", A Primer, TMH, New Delhi, Latest reprint
- Bayross, Ivan, "Java 2", BPB publication
- Schildt, Herbert, "The Complete Reference Java 2", TMH.

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M.Sc. (Computer Science)
Semester-3
MSCS-3-01P: Web Programming Lab

Total Marks: 50
External Marks: 15
Internal Marks: 35
Credits: 2
Pass Percentage: 40%

Course: Web Programming Lab	
Course Code: MSCS-3-01P	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Develop fully working applications that can be used on cross-platforms.
CO2	Create forms and check for data accuracy
CO3	Apply intermediate and advanced web development practices.
CO4	Create Web Pages that function using external data.
CO5	Develop a fully functioning website and deploy on a web server.

Detailed List of Programs:

Program No.	Name of Program
P1	Install Java Development Kit (JDK) on your system and set up the Java runtime environment. Verify the installation using command-line tools
P2	Write a simple Java program and compile it using the Java compiler. Run the compiled program and observe the output.
P3	Compare and contrast Java and C++ programming languages, highlighting key differences.
P4	Create a Java program that demonstrates the concept of byte code and explain how it is executed by the Java Virtual Machine (JVM).
P5	Implement a Java program that explores the usage of constants, variables, data types, and operators.
P6	Create a Java program to illustrate different types of inheritance, including single, multiple, and multilevel inheritance.
P7	Implement a program that showcases the use of the 'super' keyword to call

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	superclass constructors.
P8	Develop a Java application that demonstrates method overriding and dynamic method dispatch.
P9	Write a program to read input from the console and display it using predefined input/output streams.
P10	Create a Java program that utilizes one-dimensional and two-dimensional arrays. Perform operations such as sorting or searching on these arrays.
P11	Implement a program that explores string handling using both the String and String Buffer classes.
P12	Define a package and demonstrate its usage in different Java classes. Import and utilize classes from other packages.
P13	Create interfaces with variables and implement them in Java classes to achieve multiple inheritance.
P14	Develop a program that uses both interfaces and abstract classes, showcasing their differences.
P15	Write a Java program that demonstrates the different types of exceptions. Implement try-catch blocks to handle exceptions effectively.
P16	Create a program with multiple try and catch clauses and observe how the program behaves in different scenarios.
P17	Implement a custom exception class and use it in your program to handle specific error conditions.
P18	Develop a Java program with multiple threads, each performing a different task. Use thread priorities and observe the execution order.
P19	Implement synchronization mechanisms in a multi-threaded program to avoid data race conditions.
P20	Create a program that demonstrates inter-thread communication and includes features like deadlock, thread suspension, resumption, and stopping.

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M.Sc. (Computer Science)
Semester-3
MSCS-3-02T: Data Mining and Visualization

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Data Mining & Visualization	
Course Code: MSCS-3-02T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand Data Warehouse fundamentals and Data Mining tools.
CO2	Understand Data Mining Techniques
CO3	Apply clustering methods like K means, hierarchical clustering, agglomerative clustering, divisive clustering to solve problems and evaluate clusters
CO4	Gain knowledge related to application areas of data mining
CO5	Understand the components involved in data visualization design.

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SECTION-A

Unit 1: Data Mining: Introduction, Scope of Data Mining; How does Data Mining Works, Predictive Modeling: Data Mining and Data Warehousing: Architecture for Data Mining: Profitable Applications: Data Mining Tools.

Unit II: Data Pre-processing: Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Unit III: Data Mining Techniques: An Overview, Data Mining Versus Database Management System, Data Mining Techniques- Association rules, Classification, Regression, Clustering, Neural networks.

Unit IV: Clustering: Introduction, Cluster Analysis, Clustering Methods- K means, Hierarchical clustering, Agglomerative clustering, Divisive clustering, evaluating clusters.

SECTION-B

Unit V: Applications of Data Mining: Introduction, Business Applications Using Data Mining- Risk management and targeted marketing, Customer profiles and feature construction, Medical applications (diabetic screening), Scientific Applications using Data Mining, Other Applications.

Unit VI: Data Visualization: Introduction, Acquiring and Visualizing Data, Simultaneous acquisition and visualization, Applications of Data Visualization, Keys factors of Data Visualization (Control of Presentation, Faster and Better Java Script processing, Rise of HTML 5, Lowering the implementation Bar).

Unit VII: Exploring the Visual Data Spectrum: Charting Primitives (Data Points, Line Charts, Bar Charts, Pie Charts, Area Charts), Exploring advanced Visualizations (Candlestick Charts, Bubble Charts, Surface Charts, Map Charts, Infographics).

Unit VIII: Visualizing data Programmatically: starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations)

Reference Books:

- Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining Concepts and Techniques", 3rd Edition, 2000.
- Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson 2005.
- M. Kantardzic, "Data Mining: Concepts, Models, Methods, and Algorithms", 2nd edition, Wiley-IEEE Press, 2011.
- Jon Raasch, Graham Murray, Vadim Ogievetsky, Joseph Lowery, "Java Script and j Query for Data Analysis and Visualization", 2014.

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- Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2007.

M.Sc. (Computer Science)
Semester-3
MSCS-3-02P: Data Mining & Visualization Lab

Total Marks: 50
External Marks: 15
Internal Marks: 35
Credits: 2
Pass Percentage: 40%

Course: Data Mining & Visualization Lab	
Course Code: MSCS-3-02P	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Explore WEKA Data Mining/Machine Learning Toolkit.
CO2	Perform data pre-processing tasks and Demonstrate performing association rule mining on data sets.
CO3	Demonstrate the performance of Naïve-Bayes and K-Nearest Neighbor classifiers on data sets.
CO4	Evaluate the performance of Naïve-Bayes and k-Nearest Neighbor classifiers through ROC Curves
CO5	Explore visualization features of Weka to visualize the clusters.

Exp1. Explore WEKA Data Mining/Machine Learning Toolkit

- Downloading and/or installation of WEKA data mining toolkit,
- Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface,
- Experimenter, command-line interface.
- Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, classify panel, Cluster panel, Associate panel and Visualize panel)
- Study the arff file format
- Explore the available data sets in WEKA.
- Load a data set (ex. Weather dataset, Iris dataset, etc.)
- Load each dataset and observe the following:
  - List the attribute names and they types
  - Number of records in each dataset
  - Identify the class attribute (if any)

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- Plot Histogram
- Determine the number of records for each class.
- Visualize the data in various dimensions

Exp2. Perform data pre-processing tasks and Demonstrate performing association rule mining on data sets.

Exp3. Demonstrate performing classification on data sets:

- Load each dataset into Weka and run Id3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic. Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix.
- Load each dataset into Weka and perform Naïve-Bayes classification and k-Nearest Neighbor classification. Interpret the results obtained.
- Plot ROC Curves and Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.

Exp4. Demonstrate performing clustering of data sets:

- Load each dataset into Weka and run simple k-means clustering algorithm with different values of k (number of desired clusters). Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.
- Explore other clustering techniques available in Weka
- Explore visualization features of Weka to visualize the clusters. Derive interesting insights and explain.

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M.Sc. (Computer Science)
Semester-3
MSCS-3-03T: Computer Networks

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Computer Networks	
Course Code: MSCS-3-03T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Build an understanding of the fundamental concepts of computer networking.
CO2	Identify the different types of network topologies and protocols.
CO3	Understand the concept of networking models, protocols, functionality of each layer
CO4	Identify the function of a firewall, and how it keeps a computer secure and safe from viruses.
CO5	Understand the concept of Firewalls for Network Security.

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SECTION-A

Unit I: Basic Concepts: Components of data communication, modes of communication, standards and organizations, Network Classification, Network Topologies; Transmission media, network protocol; layered network architecture.

Unit II: Models: Overview of OSI reference model; TCP/IP protocol suite. Physical Layer: Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch, Router, Gateway; Transmission impairments.

Unit III: Data Link Layer: Framing techniques; Error Control; Flow Control Protocols; Shared media protocols - CSMA/CD and CSMA/CA.

Unit IV: Network Layer: Virtual Circuits and Datagram approach, IP addressing methods - Sub netting; Routing Algorithms (adaptive and non-adaptive)

SECTION-B

Unit V: Transport Layer: Elements of transport protocols – Addressing, Connection establishment and release, Flow control and buffering, Transport services, Transport Layer protocol of TCP and UDP.

Unit VI: Session and Presentation Layer: Session Layer – Design issues, remote procedure call. Presentation Layer – Design issues, Data compression techniques, Cryptography.

Unit VII: Application Layer: Application layer protocols and services – Domain name system, HTTP, E-mail, WWW, telnet, FTP, SMTP.

Unit VIII: Network Security: Common Terms, Firewalls, Virtual Private Networks

Reference Books:

- B.A. Forouzan, "Data Communication and Networking", 4th Edition, Tata McGraw Hill, 2017.
- A. S. Tanenbaum, "Computer Networks", 5th Edition, Pearson, 2011
- D.E. Comer, "Internetworking with TCP/IP", Vol. I, Prentice Hall of India, 2015
- W. Stalling, Data & Computer Communication, 8th edition, Prentice Hall of India, 2013
- D. Bertsekas, R. Gallager, Data Networks, 2nd edition, Prentice Hall of India. 1992.

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M.Sc. (Computer Science)
Semester-3
MSCS-3-04T: Introduction to Data Science

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Introduction to Data Science	
Course Code: MSCS-3-04T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand tools and techniques to analyze and extract insights from data received from different data sources such as social media, IoT devices, and sensors.
CO2	Understand the general techniques and frameworks that can be used to handle special types of data, such as acoustic, image, sensor, and network data
CO3	Apply mathematical or logical operations to the data to derive new insights.
CO4	Apply tools for understanding complex data structures and relationships.
CO5	Explore various applications of data science in the field of business, energy, health care, biotechnology, manufacturing, telecommunication, pharmaceuticals etc.

SECTION-A

Unit I: Data Science: A discipline, Landscape-Data to Data science, Data Growth-issues and challenges, data science process. foundations of data science. Messy data, Anomalies and artefacts in datasets. Cleaning data.

Unit II: Introduction data acquisition: Structured Vs Unstructured data, data preprocessing techniques including data cleaning, selection, integration, transformation and reduction, data mining, interpretation.

Unit III: Representation of Data: Special types-acoustic, image, sensor and network data. Problems when handling large data – General techniques for handling large data, Distributing data storage and processing with Frameworks.

Unit IV: Data Science Ethics: Doing good data science, Owners of the data, valuing different aspects of privacy, getting informed consent, the five Cs, diversity, inclusion, future trends.

SECTION-B

Unit V: Data Wrangling Combining and Merging Data Sets: Reshaping and Pivoting, Data Transformation, String manipulations, Regular Expressions.

Unit VI: Data Aggregation and Group Operations: Group by Mechanics, Data Aggregation, Group Wise Operations, Transformations, Pivot Tables, Cross Tabulations, Date and Time data types.

Unit VII: Data Modeling: Basics of Generative modeling and Predictive modeling. Charts-histograms, scatter plots, time series plots etc. Graphs, 3D Visualization and Presentation.

Unit VIII: Applications of Data Science: Business, Insurance, Energy, Health care, Biotechnology, Manufacturing, Utilities, Telecommunication, Travel, Governance, Gaming, Pharmaceuticals, Geospatial analytics and modeling

Reference Books:

- Sinan Ozdemir, "Principles of Data Science", Packt Publishing, 2016.
- Joel Grus, "Data Science from Scratch", O'Reilly, 2016.
- Foster Provost & Tom Fawcett, "Data Science for Business", O'Reilly, 2013.
- Roger D. Peng & Elizabeth Matsui, "The Art of Data Science", Lean Publishing, 2015.

Semester-4

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MSCS-4-01T: Machine Learning

Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Machine Learning	
Course Code: MSCS-4-01T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Understand the fundamental concepts and principles of machine learning.
CO2	Apply and evaluate various supervised learning algorithms
CO3	Explore and apply unsupervised learning techniques
CO4	Apply machine learning techniques to solve real-world problems
CO5	Evaluate the strengths and limitations of different machine learning approaches

Detailed Contents:

Module	Module Name	Module Contents
	Section-A	
Module I	**Introduction to Machine**	Introduction to ML, Applications of Machine

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	Learning	learning, machine learning as a future; Data Pre-processing: Importing the libraries, Importing the dataset, taking care of missing data, encoding categorical data, Splitting the dataset into training set and test set, Feature scaling. Simple linear regression, Multiple linear regression, Logistic Regression, K-Nearest Neighbors, Support vector machine, Decision tree classification, Random forest classification, k-means clustering
Module II	**Introduction to Artificial Neural Networks**	Introduction to ANNs, Biological Neural Networks; Usefulness and Applications of ANNs; Architectures of ANNs: Single layer, Multilayer, Competitive layer; Learning: Supervised and Unsupervised; Activation functions; Linear and Non-linear Separability
Section-B		
Module III	**Supervised Models**	**Hebb Net:** introduction, algorithm, application for AND problem; **Perceptron:** architecture, algorithm, application for OR Problem; **ADALINE:** architecture, algorithm, application for XOR problem; **MADALINE:** architecture, algorithm, application for XOR problem; **Back propagation Neural Network:** architecture, parameters, algorithm, applications, different issues regarding convergence
Module IV	**Unsupervised Models**	**Kohonen Self –Organizing Maps:** architecture, algorithm, application, **Adaptive Resonance Theory:** introduction, basic architecture, basic operation, ART1 and ART

Books

1. Andreas C. Müller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Sarah Guido, 2016
2. E. Alpaydin, "Introduction to Machine Learning", 3rd Edition, PHI Learning, 2015
3. K. P. Murphy, "Machine Learning:A Probabilistic Perspective", MIT Press, 2012
4. https://www.udemy.com/course/machinelearning

MSCS-4-02T: Research Methodology and IPR

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Total Marks: 100
External Marks: 70
Internal Marks: 30
Credits: 4
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.
4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Course: Research Methodology and IPR	
Course Code: MSCS-4-02T	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Illustrate research problem formulation.
CO2	Analyze research related information and research ethics
CO3	Summarize the present day scenario controlled and monitored by Computer and Information Technology, where the future world will be ruled by dynamic ideas, concept, creativity and innovation.
CO4	Explain how IPR would take such important place in growth of individuals & nation, to summarize the need of information about Intellectual Property Right to be promoted among student commModuley in general & engineering in particular.
CO5	Relate that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about economic growth and social benefits.

Detailed Contents:

Module	Module Name	Module Contents
	Section-A	
Module I	**Research Methodology: An Introduction**	Meaning of research problem, Sources of research problem, Criteria and Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.
Module II	**Literature Survey and Ethics**	Effective literature studies approaches, analysis Plagiarism, Research ethics.
	Section-B	
Module III	**Interpretation and Report Writing**	Effective technical writing, how to write a report, Paper Developing a Research Proposal, Format of research proposal, presentation and assessment by a review committee.
Module IV	**Footnotes, Endnotes and Intellectual Property**	Nature of Intellectual Property: Patents, Designs, Trade and Copyrights. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT

References

1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. Kothari, C. R., "Research Methodology", 3rd Ed., New Age International, 2017.
3. Ranjit Kumar, "Research Methodology – A Step by Step for Beginner's", 2nd Ed., Pearson, Education, 2016.
4. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015

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MSCS-4-03P: Major Project

Total Marks: 200
External Marks: 140
Internal Marks: 60
Credits: 10
Pass Percentage: 40%

Course: Major Project	
Course Code: MSCS-4-03P	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Gain ability to identify research gaps through literature survey, problem identification, formulation and solution.
CO3	Design solutions to problems utilizing a systems approach.
CO4	Gain ability of communication, management, leadership and entrepreneurship skills.
CO5	Obtain capability and enthusiasm for self-improvement through continuous professional development and life-long learning

Description

To develop project in the field of Computer Science & Applications

Study projects can be individual or team projects. Team projects are limited to a maximum number of 2 students (and should be defined according to the complexity of the study).

At the beginning of the 4th semester (deadline 15 March for Jan Admission Cycle and 15 October for July Admission Cycle) every student /group has to submit his/her application for the study project to the Course Coordinator for the approval of topic and team members. Within 15 days after approval the topic, the students have to write a project synopsis. The project synopsis should follow a scientific structure and consists basically of the following parts:

1. INTRODUCTION (1 PARAGRAPH)
2 LITERATURE SURVEY (2-3 pages)

(reviews of 4-5 papers/journals/articles/techniques/wares/etc)

3. RESEARCH GAPS (1 paragraph)

4. PROBLEM FORMULATION (1 paragraph)

5. OBJECTIVES OF PROJECT

The major aim of this project is to …….. To achieve the major aim, following objectives are proposed for the study

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1.

2.

3.

6. METHODOLOGY/PLANNING OF WORK (1 page)

Research type, unit, methods, tools of data collection / analysis. Methodology will include the steps to be followed to achieve the objective of the project during the project development.

7. H/W AND S/W REQUIREMENTS (1 paragraph)

Software/Hardware required for the development of the project

8. EXPECTED OUTCOMES (1 paragraph)

At the end of the study project, the students have to write a project report. The project report should follow a scientific structure and consists basically of the following parts:

1. INTRODUCTION

2 LITERATURE SURVEY

3. PROBLEM FORMULATION

4. OBJECTIVES OF PROJECT WORK

The major aim of this project is to ..... To achieve the major aim, following objectives are proposed for the study

1.

2.

3.

5. METHODOLOGY

6. MAJOR FINDINGS

7. CONCLUSIONS & FUTURE SCOPE

The length of the final project report should be about 30-35 A4 pages (about 9000-10500 words).

The due date for the final version of the report is at least one week before the official presentation. The duration of the presentation is 10-15 minutes with an additional 7 minutes for discussions.

Students will present their research findings in National/International Conferences/Seminars or published in the form of a paper in Conferences/Seminars Proceedings/Book Chapters/Journals.

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MSCS-4-04: Seminar

Total Marks: 50
External Marks: 0
Internal Marks: 50
Credits: 2
Pass Percentage: 40%

Course: Seminar	
Course Code: MSCS-4-04	
Course Outcomes (COs) After the completion of this course, the students will be able to:	
CO1	Enhance soft skill through oral presentation.
CO2	Gain ability to present literature survey, problem formulation and solution.
CO3	Prepare the proper documentation of software project following the standard guidelines
CO4	Develop technical report writing
CO5	Gain ability of discussion and questions handling.

Description

To select seminar topic in the field of Computer Science & Applications

At the beginning of the 4th semester (deadline 15 March for Jan Admission Cycle and 15 October for July Admission Cycle) every student has to submit his/her application for the seminar to the Course Coordinator for the approval of topic. Within 30 days after approval the topic, the students have to submit their seminar report to their course coordinator.

The length of the seminar report should be about 10-15 A4 pages (about 3000-4500 words).

After the submission of the seminar report, students will present their approved report. The duration of the presentation is 15-20 minutes with an additional 5 minutes for discussions.

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Bridge Course

Objective:

Bridge courses for computer science master degree programme are typically oriented around covering one of two possible deficiencies in a candidate's educational background:

- Lack of computer science skills
- Lack of math and statistical skills

Bridge course tends to provide entry-level approaches suitable for learners coming in with no real background in computer science or math or statistical or economics or operation research courses.

Therefore, to bridge the gap between non-mathematical background learners, the university has introduced a bridge course that is based on computers and mathematic statistics. This theory paper is based on internal and external evaluation to evaluate the performance of the candidate. The detail structure of this bridge course is given below:

Sr. No.	Course Code	Course Name	Credit
1	BCCSD-01	Fundamentals of Statistics & Computer Science	-

Fundamentals of Statistics & Computer Science

Course Code: BCCSD-01

Total Marks: 100
External Marks: 70
Internal Marks: 30
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER SETTER/EXAMINER

1. The syllabus prescribed should be strictly adhered to.
2. The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 10 marks each. The candidates will attempt two questions from each section.
3. Section C will have fifteen short answer questions covering the entire syllabus. Each question will carry 3 marks. Candidates will attempt any ten questions from this section.

4. The examiner shall give a clear instruction to the candidates to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.
5. The duration of each paper will be three hours.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions each from the sections A and B of the question paper and any ten short q questions from Section C. They have to attempt questions only at one place and only once. Second or subsequent attempts, unless the earlier ones have been crossed out, shall not be evaluated.

Section A

Unit I: Basic Statistics: Types of Statistics, Different Statistical Techniques, steps in Statistical Investigation, Uses and Limitations of statistics, Collection of Data: Sources of collecting primary and Secondary Data, Limitations of Secondary Data, Criteria of evaluating secondary data, Organization of data, Graphs of Grouped Frequency Distribution, Tabulation of Data, Parts of Table.

Unit II: Measures of Central Tendency: Kinds of measures of central tendency (statistical averages or averages): Arithmetic Mean, Simple Arithmetic Mean, Methods of calculating Simple Arithmetic Mean, Arithmetic Mean in case of Individual Series, Discrete series and continuous series, Weighted Arithmetic Mean, Combined Arithmetic Mean.

Unit III: Median: Methods of Calculating Median in case of Individual, Discrete series and continuous series. Partition Value: Quartile, Decile, Percentiles.

Unit IV: Mode: Methods of Calculating Mode in case of Individual Series, Discrete series and continuous series.

Section B

Unit V: Computer Appreciation: Introduction to computers, characteristics of computer; History of computers; Classification of computers on size: (Micro, Mini, Mainframe and super computers), Working Principles, Generations; Applications of computers; commonly used terms–Hardware, Software, Firmware. Basic Computer Organization: Block diagram of computer system, input unit, Processing Unit and Output Unit; Description of Computer input devices: Keyboard, Mouse, Trackball, Pen, Touch screens, Scanner, Digital Camera; Output devices: Monitors, Printers, Plotters.

Unit VI: Computer Memory: Representation of information: BIT, BYTE, Memory, Memory size; Units of measurement of storage; Main memory: Storage evaluation criteria, main memory organization, RAM, ROM, PROM, EPROM; Secondary storage devices: Sequential Access Memory, Direct Access Memory Magnetic Tapes, Magnetic disks, Optical disks: CD, DVD;

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Memory storage devices: Flash Drive, Memory card; Types of software: System and Application software.

Unit VII: Programming Languages: Generation of Languages; Translators - Interpreters, Compilers, Assemblers and their comparison.

Unit VIII: E-Commerce: Definitions: E-commerce, E-business, difference between E-commerce and E-business, Problems with Traditional business systems, Aims of E-commerce, Types of E-commerce: B2B, B2C, C2C, B2G, G2H, G2C, Operational & Strategic benefits of E-commerce, Issues & Challenges in E-commerce.

Readings Books:

1. Gupta S.C, Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons.

2. Gupta, S. P., "Statistical Methods", 2003, S. Chand.

3. Affi, A. A, "Statistical Analysis: A Computer Oriented Approach", 1979, Academic Press, Inc.

4. Priti Sinha, Pradeep K. Sinha, "Computer Fundamentals", 2004, bpb